An Analysis of Canadian Science and Technology Workers

Prepared For

The Council of Science and Technology Advisors

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1.0 Context

This report was prepared for the Council of Science and Technology Advisors who required a comparative demographic analysis of Canadian labour market conditions and trends for science and technology workers in government, academe and in identified private sector segments. This report is a follow-up to the demographic analysis of the federal science and technology (S&T) workforce analysis prepared under separate cover.

This reports provides information on the following:

- University enrolment trends in science and technology fields in Canada
- University graduation in science and technology fields in Canada
- Salaries of science graduates
- Science and technology careers in Canada
- The Canadian labour market for science occupations
- The international labour market for science occupations
- The aging Canadian workforce

2.0 Canadian University Enrolment and Graduation In Science Disciplines

The following 9 tables present the number of enrolments and graduates in science disciplines in Canada between 1994 and 1998 (more recent data is scheduled to be released in May 2002). University enrolment is covered in tables 1-3; the number of graduates is presented in tables 4-8. Table 9 presents trends in both enrolment and graduation.

Enrolment

Tables 1-3 indicate the following:

- The number of enrolments in science disciplines at the undergraduate and graduate level has increased marginally over the 5-year period under review.
- Full-time, undergraduate enrolment in science has increased by 5% between 1994 and 1999 from 138,676 enrolments in 1994-95 to 145,881 in 145,881. In contrast, enrolments in non-science fields declined 2% during the period under review. (Note that Statistics Canada includes Computer Science in the science fields. When excluded from the analysis the increase is 3%).
- Of the 21 sub-categories of undergraduate enrolment in science fields noted in Table 2, eleven fields had an increase in enrolment, 4 fields by more than 10% (excludes computer science).
- The fields of agriculture (11%), other agricultural and biological sciences (11%) and geology (23%) experienced the greatest gains in enrolments over the period.
- Caution should be used when reviewing the data by category (Table 1) given the inclusion of computer science. For example, the table indicates that the most significant increased occurred in the Mathematics and physical sciences category, (an 11% increase). A closer look at this category (Table 2) reveals that when computer science is excluded, the category experienced a 17% decline in enrolment.
- At the graduate level, enrolments have increased 3% over the period. There were gains in the health professions category (12%); and the agricultural and biological sciences fields (6%) and declines in the mathematics and physical sciences (-4.3%) and the engineering and applied sciences category (-10%).

Table 1
Full-time undergraduate enrolment by field of study, Canada 1994-1995 to 1998-1999

Field of Study	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	% Chg 1994-1999
Agriculture and biological sciences	*36,715*	*38,557*	*39,140*	*39,457*	*38,490*	*4.6%*
Engineering and applied sciences	*45,097*	*44,550*	*45,547*	*46,623*	*48,465*	*6.9%*
Health professions	*28,771*	*28,731*	*28,562*	*28,046*	*27,330*	*-5.3%*
Mathematics and physical sciences	*28,093*	*28,055*	*28,421*	*29,730*	*31,596*	*11.1%*
Education	54,962	53,433	53,799	53,790	54,223	-1.4%
Fine and applied arts	17,453	17,763	17,725	18,178	18,391	5.1%
Humanities	50,915	49,217	46,529	45,500	44,862	-13.5%
Social Sciences	156,147	153,508	152,600	151,232	150,765	-3.6%
Arts/sciences, general	62,569	69,282	67,946	66,846	67,057	6.7%
Not reported	19,778	15,093	17,767	17,670	19,772	0.0%
Grand Total	**500,500**	**498,189**	**498,036**	**497,072**	**500,951**	**0.1%**
Science Related	138,676	139,893	141,670	143,856	145,881	4.9%
Non-science Related	361,824	358,296	356,366	353,216	355,070	-1.9%

Source: Extracted from Education in Canada, 2000 Table 14 Statistics Canada - Catalogue no 81-229 p62-65

Table 2
Full-time undergraduate enrolment by field of study (detailed by science fields), Canada 1994-1995 to 1998-1999

Field of Study	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	% Chg 1994-1999
Agriculture and biological sciences						
Agriculture	3,991	4,271	4,198	4,478	4,493	11.2%
Biology	21,679	22,952	23,275	23,518	22,869	5.2%
Household science	3,893	3,733	3,864	3,743	3,391	-14.8%
Veterinary medicine	1,239	1,254	1,279	1,271	1,297	4.5%
Zoology	965	989	968	882	895	-7.8%
Other	4,948	5,358	5,556	5,565	5,545	10.8%
Total Agriculture and biological sciences	*36,715*	*38,557*	*39,140*	*39,457*	*38,490*	4.6%
Engineering and applied sciences						
Architecture	2,246	2,208	2,332	2,359	2,380	5.6%
Landscape architecture	470	497	430	364	286	-64.3%
Engineering	40,751	39,997	40,671	41,635	43,509	6.3%
Forestry	1,630	1,848	2,114	2,265	2,290	28.8%
Total Engineering and applied sciences	45,097	44,550	45,547	46,623	48,465	6.9%
Health professions						
Dental studies and research	1,690	1,678	1,726	1,743	1,810	6.6%
Medical studies and research	8,445	8,268	7,430	7,358	7,233	-16.8%
Nursing	9,144	9,380	9,665	9,229	8,883	-2.9%
Pharmacy	3,140	3,087	3,124	3,233	3,234	2.9%
Rehabilitation medicine	4,239	4,185	4,121	4,084	3,924	-8.0%
Other	2,113	2,133	2,496	2,399	2,246	5.9%
Total Health professions	28,771	28,731	28,562	28,046	27,330	-5.3%
Mathematics and physical sciences						
Chemistry	4,280	4,276	4,179	4,026	3,748	-14.2%
Geology	1,450	1,558	1,660	1,839	1,873	22.6%
Mathematics	7,990	7,304	6,666	6,163	6,206	-28.7%
Computer science	11,584	12,295	13,405	15,275	17,525	33.9%
Physics	2,693	2,538	2,440	2,366	2,188	-23.1%
Other	96	84	71	61	56	-71.4%
Total Mathematics and physical sciences	28,093	28,055	28,421	29,730	31,596	11.1%
Grand Total Science Related	**138,676**	**139,893**	**141,670**	**143,856**	**145,881**	**4.9%**

Source: Extracted from Education in Canada, 2000 Table 14 Statistics Canada - Catalogue no 81-229 p62-65

Table 3
Full-time graduate enrolment by field of study, Canada 1994-1995 to 1998-1999

Field of Study	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	% Chg 1994-1999
Agriculture and biological sciences	*5,339*	*5,414*	*5,430*	*5,408*	*5,654*	*5.6%*
Engineering and applied sciences	*9,221*	*8,802*	*8,686*	*8,488*	*8,372*	*-10.1%*
Health professions	*13,956*	*14,409*	*14,946*	*15,008*	*15,899*	*12.2%*
Mathematics and physical sciences	*7,266*	*7,100*	*6,722*	*6,666*	*6,967*	*-4.3%*
Education	6,454	6,447	6,552	6,467	6,805	5.2%
Fine and applied arts	1,559	1,576	1,561	1,590	1,632	4.5%
Humanities	9,934	9,794	9,690	9,619	9,808	-1.3%
Social Sciences	20,317	20,171	20,468	21,324	22,745	10.7%
Arts/sciences, general	680	827	862	788	927	26.6%
Not reported	487	465	682	669	616	20.9%
Grand Total	**75,213**	**75,005**	**75,599**	**76,027**	**79,425**	**5.3%**
Science Related	35,782	35,725	35,784	35,570	36,892	3.0%
Non-science Related	39,431	39,280	39,815	40,457	42,533	7.3%

Source: Extracted from *Education in Canada, 2000;* Table 16; Statistics Canada - Catalogue no 81-229 p75

Graduates

Tables 4 to 8 indicate the following:

- The number of graduates in science fields at all levels is increasing. At the Bachelor level, there was a 9% increase in graduates; 2% at the master's level and an 8% increase the number of doctorate degrees granted.

- Of the 20 sub-categories of graduates at the bachelor and first degree granted level for science fields noted in Table 4, thirteen fields had an increase in graduates, 7 fields by more than 15% (excludes computer science).

- The fields of agriculture (22%), biology (23%) and geology (32%) experienced the greatest gains in bachelor and first degree granted over the period.

- An analysis by gender (Tables 6,7,8) indicated that while the number of males exceeds the number of females in science fields, the percentage increase of females graduating exceeds that of males at the bachelor, master and PhD levels. For example, there was a 3% increase in the number of males receiving science related doctorate degrees and an increase of 24% in the number of females receiving a doctorate.

- The chart (Table 9) prepared by the Association of Universities and Colleges of Canada, indicates that recent trends (1988 – 1998) suggest stable PhD production in the mid-term.

Table 4
Bachelor & First Degree Granted by field of study, Canada 1994-1995 to 1998-1999

Field of Study	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	% Chg 1994-1999
Agriculture and biological sciences						
Agriculture	520	536	546	612	666	21.9%
Biology	4,916	5,101	5,846	6,071	6,349	22.6%
Household science	1,073	982	1,027	989	1,064	-0.8%
Veterinary medicine	278	285	286	296	299	7.0%
Zoology	320	278	354	367	351	8.8%
Other	1,014	1,217	1,229	1,328	1,350	24.9%
Total Agriculture and biological sciences	*8,121*	*8,399*	*9,288*	*9,663*	*10,079*	19.4%
Engineering and applied sciences						
Architecture	558	534	550	573	571	2.3%
Landscape architecture	86	78	95	81	84	-2.4%
Engineering	7,855	8,234	8,454	8,120	8,233	4.6%
Forestry	300	252	316	364	367	18.3%
Total Engineering and applied sciences	8,799	9,098	9,415	9,138	9,255	4.9%
Health professions						
Dental studies and research	440	436	414	432	431	-2.1%
Medical studies and research	2,404	2,342	2,252	2,193	2,275	-5.7%
Nursing	2,824	3,133	3,336	3,731	3,316	14.8%
Pharmacy	770	797	839	689	791	2.7%
Rehabilitation medicine	1,236	1,313	1,304	1,328	1,232	-0.3%
Other	296	354	488	464	575	48.5%
Total Health professions	7,970	8,375	8,633	8,837	8,620	7.5%
Mathematics and physical sciences						
Chemistry	984	987	1,010	1,066	1,107	11.1%
Geology	347	356	377	402	509	31.8%
Mathematics	2,215	2,182	2,012	1,957	1,808	-22.5%
Computer science	2,567	2,949	2,984	3,012	3,186	19.4%
Physics	677	640	604	633	623	-8.7%
Other	26	28	18	21	6	-333.3%
Total Mathematics and physical sciences	6,816	7,142	7,005	7,091	7,239	5.8%
Education	21,123	21,277	21,421	20,639	19,374	-9.0%
Fine and applied arts	4,189	4,194	4,142	4,105	4,276	2.0%
Humanities	16,643	16,127	15,889	15,014	14,721	-13.1%
Social Sciences	49,172	49,035	48,422	47,751	47,760	-3.0%
Not reported	3,705	3,684	3,774	3,559	3,537	-4.7%
Grand Total Science Related	**31,706**	**33,014**	**34,341**	**34,729**	**35,193**	**9.9%**
Total	**126,538**	**127,331**	**127,989**	**125,797**	**124,861**	**-1.3%**

Source: Extracted from *Education in Canada, 2000;* Table 37; Statistics Canada - Catalogue no 81-229 p136

Table 5
University qualifications[1] granted by field of study, by sex

Field of Study	1994	1995	1996	1997	1998	% Chg 1994-1998
Canada	**178,074**	**178,066**	**178,116**	**173,937**	**172,076**	**-3%**
Male	**76,470**	**76,022**	**75,106**	**73,041**	**71,949**	**-6%**
Female	**101,604**	**102,044**	**103,010**	**100,896**	**100,127**	**-1%**
Social sciences	69,583	68,685	67,862	66,665	67,019	-4%
Male	30,700	29,741	29,029	28,421	27,993	-9%
Female	38,883	38,944	38,833	38,244	39,026	0%
Education	30,369	30,643	29,792	27,807	25,956	-15%
Male	9,093	9,400	8,693	8,036	7,565	-17%
Female	21,276	21,243	21,099	19,771	18,391	-14%
Humanities	23,071	22,511	22,357	21,373	20,816	-10%
Male	8,427	8,428	8,277	8,034	7,589	-10%
Female	14,644	14,083	14,080	13,339	13,227	-10%
Health professions and occupations	12,183	12,473	12,895	13,073	12,658	4%
Male	3,475	3,461	3,517	3,460	3,514	1%
Female	8,708	9,012	9,378	9,613	9,144	5%
Engineering and applied sciences	12,597	12,863	13,068	12,768	12,830	2%
Male	10,285	10,284	10,446	10,125	10,121	-2%
Female	2,312	2,579	2,622	2,643	2,709	17%
Agriculture and biological sciences	10,087	10,501	11,400	11,775	12,209	21%
Male	4,309	4,399	4,756	4,780	4,779	11%
Female	5,778	6,102	6,644	6,995	7,430	29%
Mathematics and physical sciences	9,551	9,879	9,786	9,738	9,992	5%
Male	6,697	6,941	6,726	6,749	6,876	3%
Female	2,854	2,938	3,060	2,989	3,116	9%
Fine and applied arts	5,308	5,240	5,201	5,206	5,256	-1%
Male	1,773	1,740	1,780	1,706	1,735	-2%
Female	3,535	3,500	3,421	3,500	3,521	0%
Arts and sciences	5,325	5,271	5,755	5,532	5,340	0%
Male	1,711	1,628	1,882	1,730	1,777	4%
Female	3,614	3,643	3,873	3,802	3,563	-1%

1. Includes bachelor"s and first professional degrees, undergraduate diplomas and certificates, other undergraduate qualifications, master's degrees, doctoral degrees, and graduate diplomas and certificates.

Source: Statistics Canada, CANSIM, cross-classified table 00580602. (Calculation added)

Table 6
Bachelor's Degrees, by field of study and sex, 1994 – 1998

Bachelor's Field of Study	Gender	1994	1995	1996	1997	1998	% Chg 1994-1998
Agriculture	*Total*	*520*	*536*	*546*	*612*	*666*	*21.9%*
	M	*251*	*245*	*238*	*282*	*290*	*13.4%*
	F	*269*	*291*	*308*	*330*	*376*	*28.5%*
Biology	*Total*	*4,916*	*5,101*	*5,846*	*6,071*	*6,349*	*22.6%*
	M	*2,092*	*2,158*	*2,493*	*2,472*	*2,515*	*16.8%*
	F	*2,824*	*2,943*	*3,353*	*3,599*	*3,834*	*26.3%*
Veterinary Medicine	*Total*	*278*	*285*	*286*	*296*	*299*	*7.0%*
	M	*97*	*83*	*92*	*81*	*93*	*-4.3%*
	F	*181*	*202*	*194*	*215*	*206*	*12.1%*
Zoology	*Total*	*320*	*278*	*354*	*367*	*351*	*8.8%*
	M	*152*	*114*	*148*	*144*	*112*	*-35.7%*
	F	*168*	*164*	*206*	*223*	*239*	*29.7%*
Health Professions	*Total*	*7,970*	*8,375*	*8,633*	*8,837*	*8,620*	*7.5%*
	M	*2,307*	*2,354*	*2,293*	*2,268*	*2,383*	*3.2%*
	F	*5,663*	*6,021*	*6,340*	*6,569*	*6,237*	*9.2%*
Engineering and Applied Sciences	*Total*	*8,799*	*9,098*	*9,415*	*9,138*	*8,924*	*1.4%*
	M	*7,205*	*7,251*	*7,506*	*7,201*	*7,289*	*1.2%*
	F	*1,594*	*1,847*	*1,909*	*1,937*	*1,635*	*2.5%*
Mathematics and Physical Sciences	*Total*	*6,816*	*7,142*	*7,005*	*7,091*	*7,239*	*5.8%*
	M	*4,700*	*4,961*	*4,729*	*4,820*	*4,976*	*5.5%*
	F	*2,116*	*2,181*	*2,276*	*2,271*	*2,263*	*6.5%*
Total Science Disciplines	*Total*	*29,619*	*30,815*	*32,085*	*32,412*	*32,448*	*8.7%*
	M	*16,804*	*17,166*	*17,499*	*17,268*	*17,658*	*4.8%*
	F	*12,815*	*13,649*	*14,586*	*15,144*	*14,790*	*13.4%*
NON-SCIENCE PROGRAMS							
Humanities	Total	16,643	16,127	15,889	15,014	14,721	-13.1%
	M	5,999	5,973	5,866	5,579	5,277	-13.7%
	F	10,644	10,154	10,023	9,435	9,444	-12.7%
Fine and Applied Arts	Total	4,189	4,194	4,142	4,105	4,276	2.0%
	M	1,413	1,418	1,442	1,384	1,420	0.5%
	F	2,776	2,776	2,700	2,721	2,856	2.8%
Education	Total	21,123	21,277	21,421	20,639	19,374	-9.0%
	M	6,261	6,512	6,235	5,912	5,695	-9.9%
	F	14,862	14,765	15,186	14,727	13,679	-8.6%

Source: "Education in Canada 2000", Ministry of Industry, May 2001

Table 7
Master's Degrees, by field of study and sex, 1994 - 1998

Master's Field of Study	Gender	1994	1995	1996	1997	1998	% Chg 1994-1998
Agriculture & Biological Sciences	*Total*	*924*	*1001*	*986*	*993*	*972*	*4.9%*
	M	*483*	*482*	*432*	*439*	*434*	*-11.3%*
	F	*441*	*519*	*554*	*554*	*538*	*18.0%*
Health Professions	*Total*	*1,541*	*1,538*	*1,505*	*1,602*	*1,625*	*5.2%*
	M	*466*	*455*	*455*	*475*	*458*	*-1.7%*
	F	*1,075*	*1,083*	*1,050*	*1,127*	*1,167*	*7.9%*
Engineering and Applied Sciences	*Total*	*2,291*	*2,243*	*2,217*	*2,167*	*2,182*	*-5.0%*
	M	*1,855*	*1,793*	*1,735*	*1,682*	*1,659*	*-11.8%*
	F	*436*	*450*	*482*	*485*	*523*	*16.6%*
Mathematics and Physical Sciences	*Total*	*1,283*	*1,340*	*1,413*	*1,340*	*1,398*	*8.2%*
	M	*930*	*980*	*978*	*945*	*907*	*-2.5%*
	F	*353*	*360*	*435*	*395*	*491*	*28.1%*
Total Science Disciplines	*Total*	*6,039*	*6,122*	*6,121*	*6,102*	*6,177*	*2.2%*
	M	*3,734*	*3,710*	*3,600*	*3,541*	*3,458*	*-8.0%*
	F	*2,305*	*2,412*	*2,521*	*2,561*	*2,719*	*15.2%*
NON-SCIENCE PROGRAMS							
Humanities	Total	2,861	2,765	2,799	2,750	2,742	-4.3%
	M	1,215	1,152	1,179	1,192	1,118	-8.7%
	F	1,646	1,613	1,620	1,558	1,624	-1.4%
Fine and Applied Arts	Total	529	487	510	515	490	-8.0%
	M	216	181	208	189	197	-9.6%
	F	313	306	302	326	293	-6.8%
Education	Total	3,437	3,704	3,455	3,329	3,330	-3.2%
	M	1,062	1,096	974	995	920	-15.4%
	F	2,375	2,608	2,481	2,334	2,410	1.5%

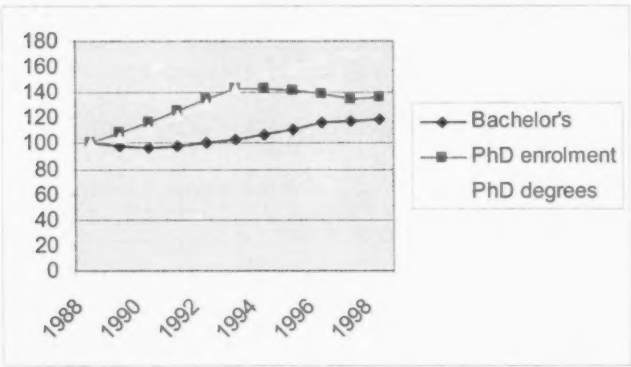
Source: "Education in Canada 2000", Ministry of Industry, May 2001

Table 8
Doctorate Degrees, by field of study and sex, 1994 - 1998

Doctorate Field of Study	Gender	1994	1995	1996	1997	1998	% Chg 1994-1998
Agriculture & Biological Sciences	*Total*	*434*	*441*	*460*	*475*	*437*	*0.7%*
	M	*308*	*290*	*296*	*312*	*282*	*-9.2%*
	F	*126*	*151*	*164*	*163*	*155*	*18.7%*
Health Professions	*Total*	*407*	*408*	*457*	*492*	*509*	*20.0%*
	M	*246*	*250*	*258*	*251*	*291*	*15.5%*
	F	*161*	*158*	*199*	*241*	*218*	*26.1%*
Engineering and Applied Sciences	*Total*	*598*	*673*	*650*	*686*	*679*	*11.9%*
	M	*554*	*610*	*577*	*620*	*605*	*8.4%*
	F	*44*	*63*	*73*	*66*	*74*	*40.5%*
Mathematics and Physical Sciences	*Total*	*685*	*666*	*733*	*694*	*695*	*1.4%*
	M	*563*	*551*	*598*	*574*	*544*	*-3.5%*
	F	*122*	*115*	*135*	*120*	*151*	*19.2%*
Total Science Disciplines	*Total*	*2,124*	*2,188*	*2,300*	*2,347*	*2,320*	*8.4%*
	M	*1,671*	*1,701*	*1,729*	*1,757*	*1,722*	*3.0%*
	F	*453*	*487*	*571*	*590*	*598*	*24.2%*
NON-SCIENCE PROGRAMS							
Humanities	Total	381	395	476	474	482	21.0%
	M	226	240	264	255	269	16.0%
	F	155	155	212	219	213	27.2%
Fine and Applied Arts	Total	30	40	33	49	35	14.3%
	M	18	24	19	25	21	14.3%
	F	12	16	14	24	14	14.3%
Education	Total	368	348	363	377	367	-0.3%
	M	167	161	145	141	142	-17.6%
	F	201	187	218	236	225	10.7%

Source: "Education in Canada 2000", Ministry of Industry, May 2001

Table 9
Recent Trends Suggest Stable PhD Production in The Mid-term
(Science Disciplines Index=100)



Source: AUCC

Salary of University Graduates in Science Disciplines

- While the information is somewhat dated (June 1995), a review of the salary levels of 1990 university graduates working full time in June 1995 indicates that science grads at the bachelor level earned between $35,000 and $52,000. For those with master's degrees, the salary ranged between $40,000 and $50,000. At the doctorate level, salary ranges were $38,000 - $59,000.

- Generally speaking, women earned less than men. The only exceptions were: women in the mathematics and physical sciences category at the doctorate level; women in health professions at the masters levels; and, in agricultural and biological sciences where women ether earned the same as their male counterparts or earned $1000 more annually.

Table 10
Estimated Median Annual Earnings of 1990 university graduates working full time in June 1995, by major field of Study and sex, Canada

Field of Study	Bachelor's1	Master's	Doctorate
Agriculture & Biological Sciences	*$35,000*	*$40,000*	*$48,000*
Male	*$35,000*	*$42,000*	*$50,000*
Female	*$35,000*	*$40,000*	*$38,000*
Engineering and applied sciences	*$45,000*	*$50,000*	*$58,000*
Male	*$45,000*	*$50,000*	*$59,000*
Female	*$42,000*	*$48,000*	**
Health professions	*$45,000*	*$50,000*	*$55,000*
Male	*$52,000*	*$49,000*	*$54,000*
Female	*$43,000*	*$50,000*	*$56,000*
Mathematics and physical sciences	*$41,000*	*$46,000*	*$50,000*
Male	*$42,000*	*$46,000*	*$50,000*
Female	*$40,000*	*$45,000*	*$51,000*
Education	$39,000	$55,000	$60,000
Male	$40,000	$48,000	$64,000
Female	$38,000	$53,000	$58,000
Fine and applied arts	$31,000	$32,000	**
Male	$30,000	**	**
Female	$32,000	**	**
Humanities	$33,000	$40,000	$52,000
Male	$34,000	$38,000	$56000*
Female	$32,000	$40,000	$50,000
Social Sciences	$36,000	$45,000	$55,000
Male	$40,000	$45,000	$55,000
Female	$35,000	$45,000	$56,000
Arts and sciences general	$40,000	$50,000	**
Male	$40,000	$50,000	**
Female	$38,000	$49,000	**
Canada	**$38,000**	**$50,000**	**$54,000**
Male	**$40,000**	**$52,000**	**$55,000**
Female	**$37,000**	**$50,000**	**$53,000**

1 Includes bachelor's and first professional degrees as well as undergraduate diplomas and certificates.
* This number has a coefficient of variation between 16.6% and 25% and are less reliable than unmarked numbers

** These numbers have a coefficient of variation greater thank 25%; they should be used with caution and are therefore not reliable enough to be released

Source: Extracted from *Education in Canada, 2000;* Table 51; Statistics Canada - Catalogue no 81-229 p165. Source: Survey of 1990 Graduates, June 1995. Centre for Education Statistics, Statistics Canada

3.0 Science and Technology Careers in Canada[1]

In the fall of 1997, Statistics Canada published an analysis of the careers of recent university graduates in science and technology. The following highlights were extracted **verbatim** from that report:

- Developing an interesting career in the applied sciences seems to have required going beyond the bachelor's degree, since employment opportunities, earnings and job satisfaction levels have generally been amongst the lowest for all graduates at the level but have been considerably higher at the master's and especially the doctorate level.

- Applied sciences graduates generally expressed the lowest levels of satisfaction with their choice of educational program (especially at the bachelor's level). The dissatisfaction may be a good summary measure of the relative lack of opportunities for interesting and rewarding careers they face, as well as an indication of the difficulties that may be encountered in attracting talented individuals into these disciplines in the future.

- Choosing a career in pure sciences has generally been associated with more positive outcomes than choosing one in applied sciences, but graduates have generally lagged behind those of the other science and technology fields (health, computer science, engineering) and in many cases have not fared as well as the SSH (social sciences, humanities and others) comparison group. Thu, a degree in pure sciences has been no guarantee of particularly abundant or interesting job opportunities at least not ones directly related to the degree. Overall satisfaction with the program choice has also not been very high.

- A degree in a health discipline has generally led to the greatest certainty of finding a job, and of that job being one closely related to the education program and one in which earnings and satisfaction levels are high. Health graduates have also expressed high levels of overall satisfaction with their choice of education program.

- Despite their moderately high unemployment rates in certain years, engineering graduates have generally expressed high levels of satisfaction with their jobs and their choices of education program, and have enjoyed reasonably high earnings levels. Regarding the job education skill match and job prerequisites, engineers seem to have been particularly well prepared for the job market: otherwise viewed, the marker for engineers seems to have done well at matching graduates to jobs.

[1] *Education Quarterly Review*, Statistics Canada, Fall 1997, Vol. 4, no. 3, catalogue no. 81-003-XPB p. 7-8

4.0 Science and Technology Labour Market

Statistics Canada defines the labour market in many ways – by industry, by broad occupational categories, by detailed industry, by industry division. In all cases it is necessary to make assumptions as to where science and technology workers with similar skills and qualifications to the federal government may be employed.

For purposes of this analysis of the science and technology labour market, the "broad occupational category" was used because it most closely follows S&T categories. Table 11 is extracted from Statistics Canada data relating to the distribution of the labour force by broad occupational categories for males and females based on the 1991 census and the 1996 census. For purposes of this analysis it has been assumed that the following occupations categories contain science workers:

- Natural and applied sciences and related occupations
- Health occupations
- Occupations unique to primary industry

Given these assumptions, the table indicates that science and technology workers accounted for 30% of the labour market in 1991 and in 1996. The table also indicated that there are more males than females in the science and technology labour market.

By way of comparison, Table 12 presents a graph extracted from a review of S&T labour markets in OECD Countries. The graph indicates and the reports states that persons working in an S&T occupation accounted for 20-30% of the labour force in the European Union countries surveyed.

The report - Background Report An analysis of S&T Labour Markets in OECD Countries by Mario Cervantes, science and Technology Division, OECD, presented at the OECD Workshop on S&T Labour markets, May 17, 1999 concluded the following:

> *"Human resources in science and technology labour markets are of vital importance to the competitiveness of OECD economies. While measuring the number of people working and/or educated in science and technology is a highly complex issue, the above analysis confirms the growing demand for S&T labour across sectors and countries but also reveals profound mutations in the labour market for S&T personnel. A trend rise in temporary employment, a decline in public employment and rapidly changing skill requirements all increase pressures for greater flexibility and mobility in S&T labour markets. Across sectors and firms, employers are seeking S&T personnel with multiple skills who can adapt quickly to new tasks and to changing market demands. Even the public research sector which still employs a significant share of S&T personnel in some countries, is facing the same challenges as industry (e.g. globalization of research, rising research costs, shrinking budgets, and need for*

multidisciplinary skills) with implications for supply and demand of S&T personnel."[2]

It would appear that the issues facing the Canadian S&T labour market are similar to those experienced in other countries specifically the use of temporary workers (i.e. terms), decline in public employment (although there have been gains over the last 2 years), and rapidly changing skill requirements.

That report concludes with the following recommendation:

> *"Meeting the challenges that lie ahead for S&T personnel will require strengthening partnerships between OECD governments and business to provide workers with the skills for the knowledge economy and to remove impediments to their contribution to advancing research and innovation."*[3]

Table 11
Labour Force 15 Years and Over by Broad Occupational Categories and Major Groups (Based on the 1991 Standard Occupational Classification) and Sex, for Canada, Provinces and Territories, 1991 and 1996 census (20% Sample Data)

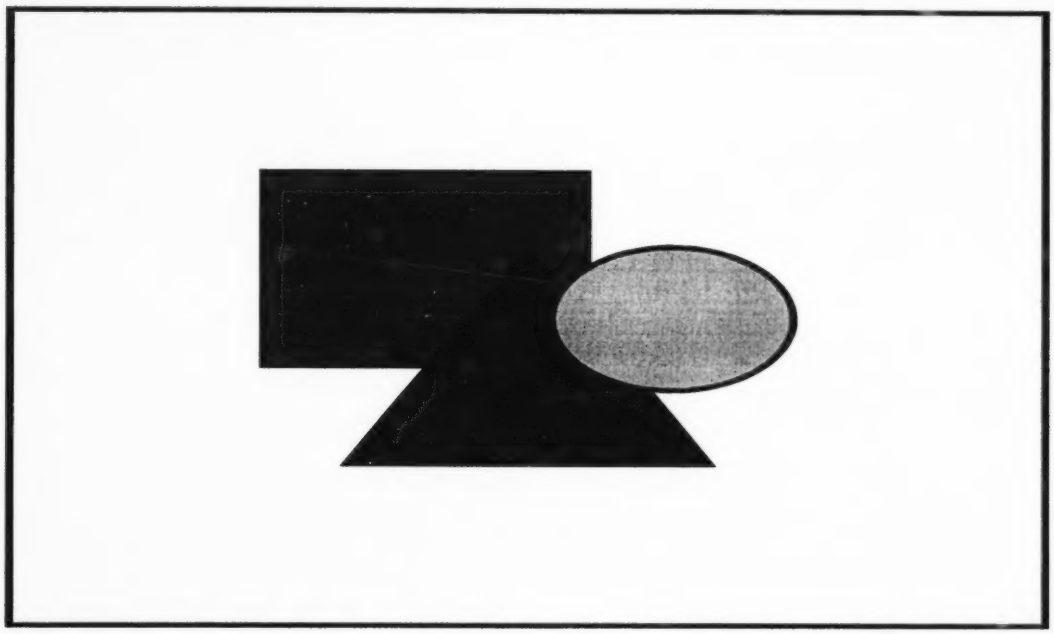
Occupation	Both Sexes		Males		Females	
	1991	1996	1991	1996	1991	1996
SCIENCE RELATED						
C. Natural and Applied sciences and related occupations	*669,970*	*712,495*	*555,930*	*585,420*	*114,040*	*127,080*
C0 Professional occupations in natural and applied sciences	*347,680*	*385,440*	*283,420*	*309,040*	*64,230*	*76,400*
C1 Technical occupations related to natural and applied sciences	*322,290*	*327,060*	*272,510*	*276,375*	*49,780*	*50,685*
D. Health Occupations	*703,930*	*719,450*	*148,585*	*152,825*	*555,340*	*566,625*
D0 Professional occupations in health	*124,965*	*144,495*	*72,195*	*76,705*	*52,775*	*67,785*
D1 Nurse supervisors and registered nurses	*249,365*	*246,800*	*12,495*	*13,035*	*236,870*	*233,765*
D2 Technical and related occupations in health	*171,870*	*162,770*	*39,475*	*39,290*	*132,395*	*123,480*
D3 Assisting occupations in support of health services	*157,725*	*165,385*	*24,420*	*23,790*	*133,305*	*141,590*
I. Occupations unique to primary industry	*734,515*	*680,685*	*569,245*	*534,015*	*165,265*	*146,670*
I0 Occupations unique to agriculture excluding labourers	*465,145*	*424,925*	*330,380*	*304,865*	*134,765*	*120,055*

[2] Background Report an analysis of S&T Labour Markets in OECD Countries by Mario Cervantes, science and Technology Division, OECD. Presented at the OECD Workshop on S&T Labour markets, May 17, 1999 p 59
[3] IBID, p 60

Occupation	Both Sexes		Males		Females	
	1991	1996	1991	1996	1991	1996
I1 Occupations unique to forestry operations, mining, oil and gas extraction and fishing, excluding labourers	*139,315*	*135,475*	*131,300*	*127,835*	*8,015*	*7,640*
I2 Primary production labourers	*130,055*	*120,290*	*107,565*	*101,315*	*22,490*	*18,975*
NON-SCIENCE RELATED						
A Management Occupations	1,383,410	1,289,125	974,710	880,240	408,700	408,885
B Business Finance and administrative occupations	2,727,160	2,718,250	709,580	766,570	2,017,580	1,951,680
E Occupations in social science, education, government services and religion	917,835	975,385	388,250	393,715	529,585	581,670
F Occupations in art, culture, recreation and sport	337,355	386,315	156,780	179,930	180,575	206,390
G Sales and service occupations	3,476,380	3,724,430	1,533,475	1,609,510	1,942,910	2,114,920
H Trades, transport equipment operators and related occupations	2,199,375	2,018,355	2,059,220	1,896,255	140,160	122,100
J Occupations unique to processing, manufacturing and utilities	734,515	680,685	569,245	534,015	165,265	146,670
Total Labour Force	14,474,945	14,812,700	79,957,835	8,007,955	6,517,110	6,804,750
Occupation Not applicable	854,710	495,160	118,590	239,470	136,120	255,690
All Occupations	**14,220,235**	**14,317,545**	**7,839,245**	**7,768,485**	**6,380,985**	**6,549,060**
Total Science Occupational Categories	**4,216,825**	**4,225,270**	**2,547,520**	**2,544,510**	**1,669,270**	**1,680,750**
% of Total Labour Force	**30%**	**30%**	**32%**	**33%**	**26%**	**26%**

Extracted from Extracted from Statistics Canada Catalogue no. 93F0027XDB96007 in the Nation Series (Science total and % added)

Table 12
Persons employed in and S&T Occupations as a Percentage of the Labour Force in Selected OECD Countries



Source: Background Report An analysis of S&T Labour Markets in OECD Countries by Mario Cervantes, science and Technology Division, OECD. Presented at the OECD Workshop on S&T Labour markets, May 17, 1999

5.0 The Aging Workforce

The demographic analysis of the federal Science and Technology workforce indicated that the population was aging. In fact, as of November 30, 2001, 13.3% of the population was 55 years or older. Table 13 presents the age profile of the Canadian population based on the 2001 census. The table indicates that 22% of Canadians are 55 years of age or over.

William B.P. Robson writes in Aging Populations and the Workforce – Challenges for Employers that the birth rate has declined since the 1960's and that, as a result, the growth in the population considered to be of labour force age (15-64-years olds) is slowing. By the second decade it is projected to grow very sluggishly and by the following decade, the population aged 15-64 is likely to stagnate or shrink (Table 14).

The study of the impact of this trend on employers indicates:

> *... the potentially chronic labour shortages that loom ahead will require responses in many areas – hiring and contracting, work scheduling, training, compensation and job assignment, and workplace organization. Many current public policies are inconsistent with future needs, and the long lead times for reform mean that employers need to keep policy makers abreast of the challenges and urge them to timely action."*[4]

Table 13
Canada's Population by Sex and Age

	2001					
	Both sexes	Male	Female	**Both sexes**	Male	Female
	number			% of total population		
All ages	**31,081,887**	**15,388,494**	**15,693,393**	**100**	**100**	**100**
0–4	**1,734,005**	886,798	847,207	**5.6**	5.8	5.4
5–9	**2,030,513**	1,039,900	990,613	**6.5**	6.8	6.3
10–14	**2,077,877**	1,065,487	1,012,390	**6.7**	6.9	6.5
15–19	**2,085,004**	1,071,010	1,013,994	**6.7**	7	6.5
20–24	**2,111,244**	1,077,633	1,033,611	**6.8**	7	6.6
25–29	**2,120,333**	1,072,875	1,047,458	**6.8**	7	6.7
30–34	**2,274,092**	1,147,864	1,126,228	**7.3**	7.5	7.2
35–39	**2,655,304**	1,339,855	1,315,449	**8.5**	8.7	8.4
40–44	**2,662,148**	1,332,702	1,329,446	**8.6**	8.7	8.5
45–49	**2,384,489**	1,189,366	1,195,123	**7.7**	7.7	7.6
50–54	**2,112,758**	1,052,514	1,060,244	**6.8**	6.8	6.8
55–59	**1,624,744**	803,402	821,342	**5.2**	5.2	5.2
60–64	**1,291,501**	631,077	660,424	**4.2**	4.1	4.2
65–69	**1,136,356**	546,895	589,461	**3.7**	3.6	3.8
70–74	**1,010,538**	463,554	546,984	**3.3**	3	3.5

[4] Aging Populations and the Workforce, Challenges for Employers by William B.P. Robson and A BNAC Statement, July 19, 2001 p 1

	2001					
	Both sexes	Male	Female	**Both sexes**	Male	Female
75–79	**816,617**	340,125	476,492	**2.6**	2.2	3
80–84	**523,743**	196,102	327,641	**1.7**	1.3	2.1
85–89	**289,316**	94,574	194,742	**0.9**	0.6	1.2
90 and over	**141,305**	36,761	104,544	**0.5**	0.2	0.7

Source: Statistics Canada, CANSIM II Table 051-0001 Last Modified March 28, 2002

Table 14
Annual Growth of Population, United States, United Kingdom, and Canada, 1960-2030

	United States	**United Kingdom**	**Canada**
% Growth			
	Ages 15-64		
1960-90	1.4	0.3	1.9
1990-2000	1.0	0.4	1.1
2000-10	1.0	0.5	0.9
2010-20	0.3	0.0	0.1
2020-30	0.2	-0.3	-0.3
	Ages 65 and Over		
1960-90	2.2	1.3	2.8
1990-2000	1.1	0.3	2.1
2000-10	1.3	0.8	2
2010-20	3.1	1.8	3.3
2020-30	2.7	1.9	2.8

Sources: Extracted from Aging Populations and the Workforce, Challenges for Employers by William B.P. Robson and A BNAC Statement
Sources: United States: US Bureau of the Census; projections from the Centre for Strategic and International Studies; United Kingdom; National Statistics database ad Government Actuary's office; Canada: Statistics Canada, CANSIM database; C.D. Howe Institute projections